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H01R 13/42

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H2E EDAB

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(58) Field of search
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INT CL⁶ H01R

(54) Mounting contacts in an electrical connector

(57) A multiple contact connector (34) has a contact holder member (14, 15) into which a multiplicity of contacts (3) are transversely inserted and then locked in place by slidable fasteners (16a, 16b). The connector may be a plug (as shown) or socket, and can be configured as a "D" connector or SCART plug.

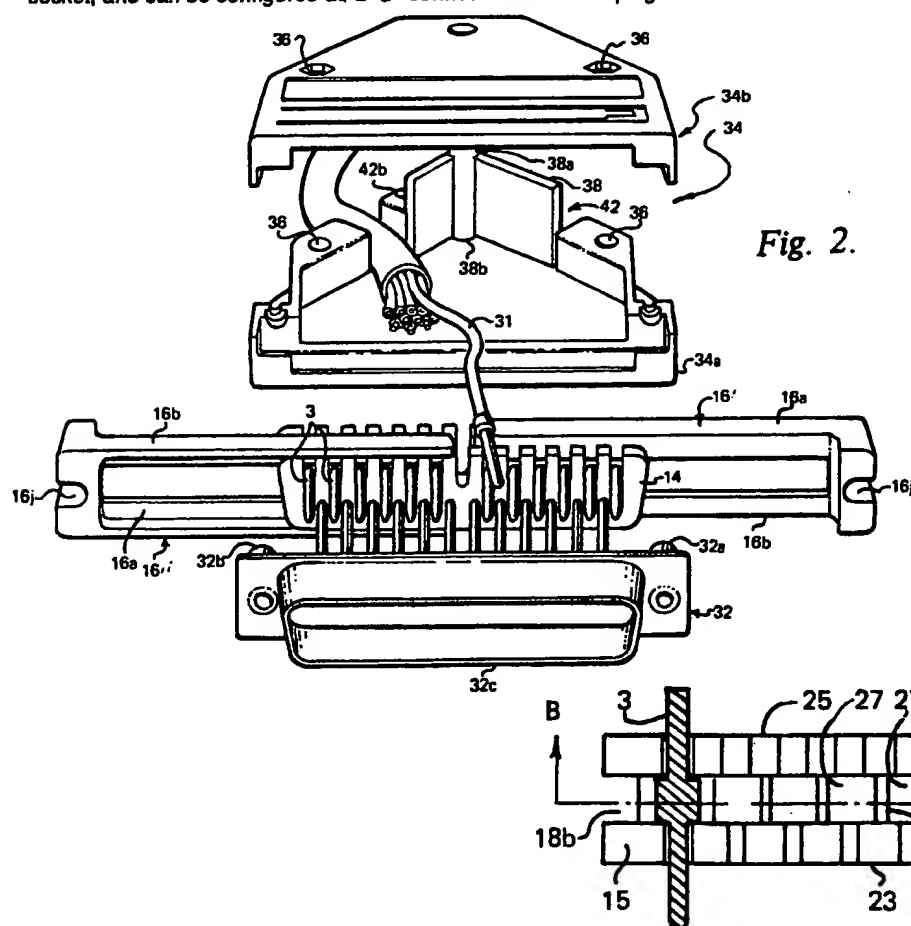


Fig. 4c.

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

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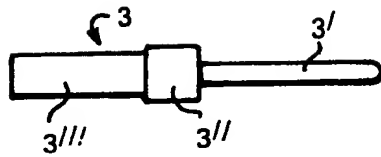


Fig. 6.

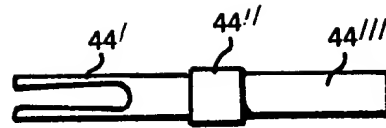


Fig. 7.

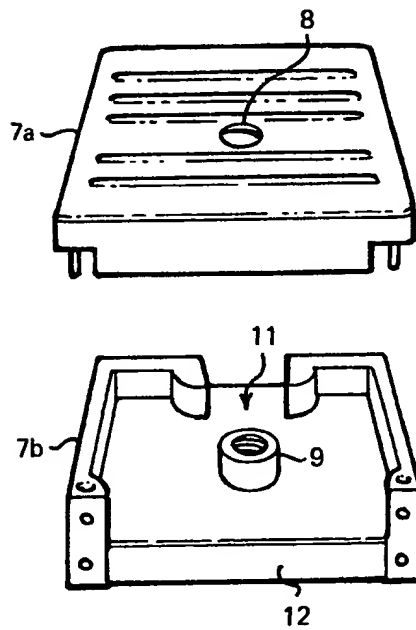


Fig. 1a.

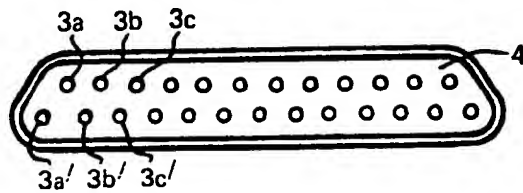
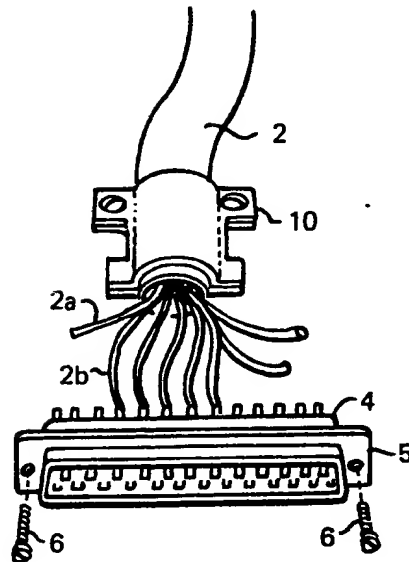


Fig. 1b.

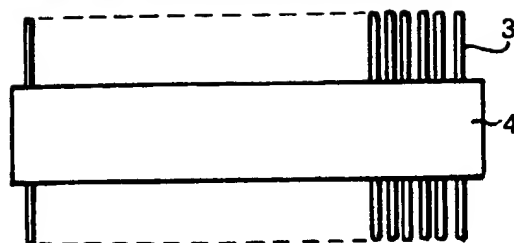
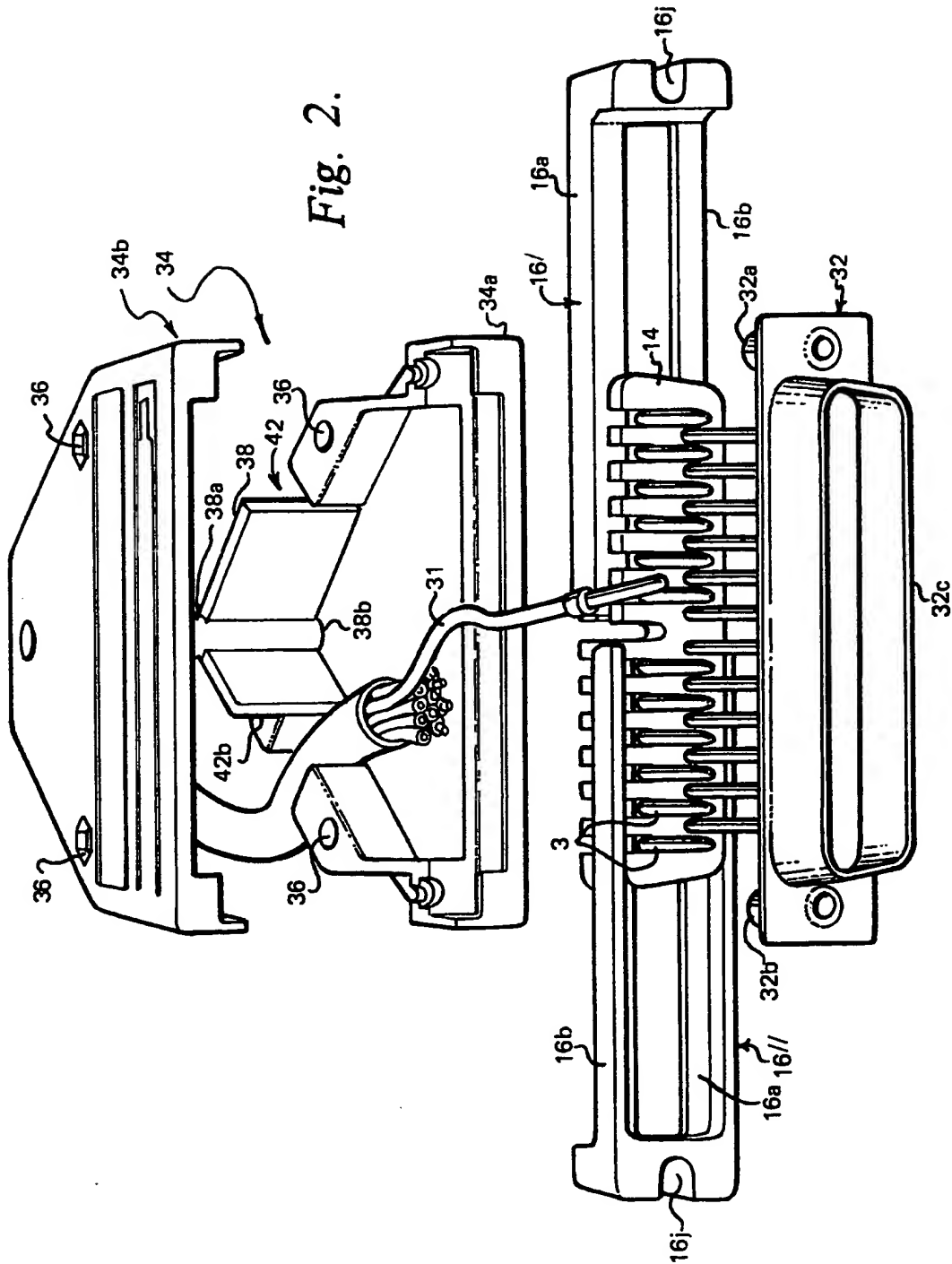


Fig. 1c.

Fig. 2.



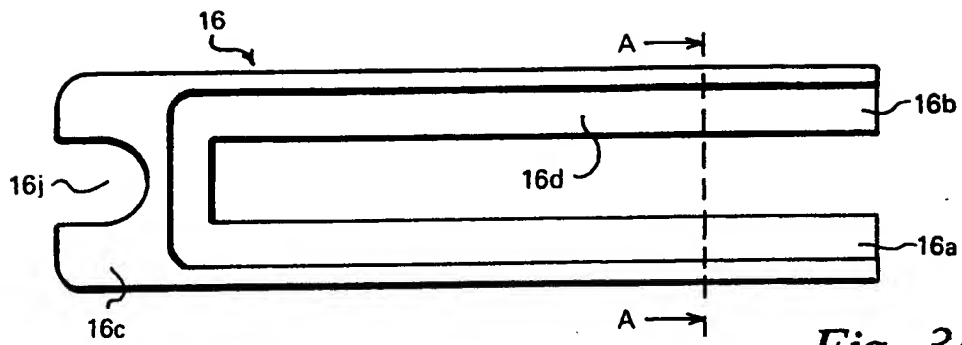


Fig. 3a.

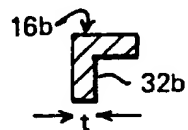


Fig 3b.

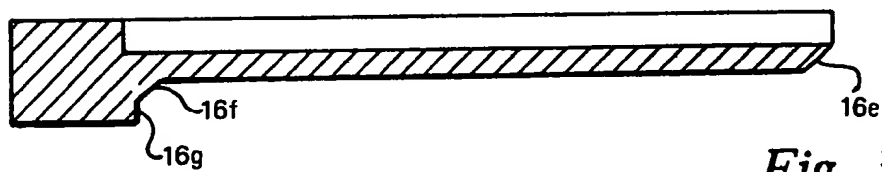
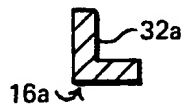


Fig. 3d.

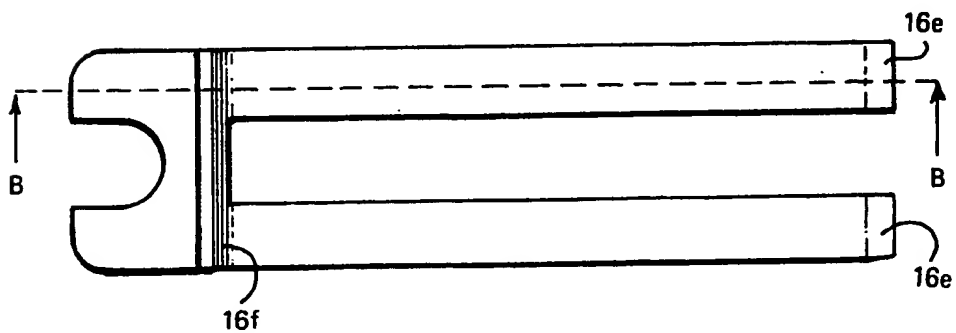


Fig. 3c.

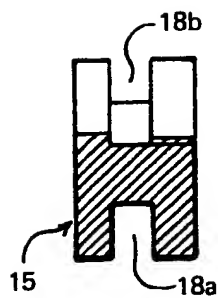


Fig. 4b.

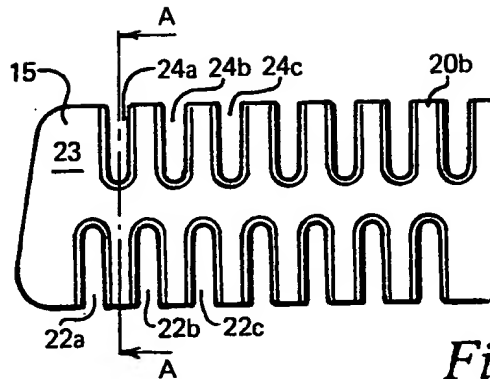


Fig. 4a.

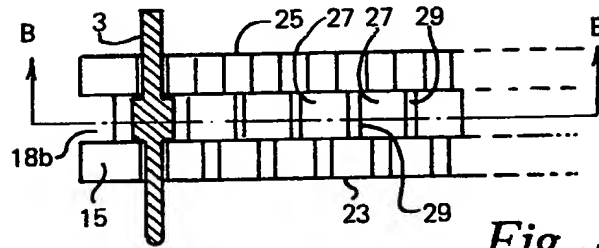


Fig. 4c.

Fig. 4f.

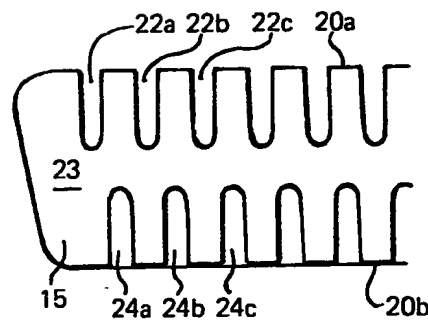
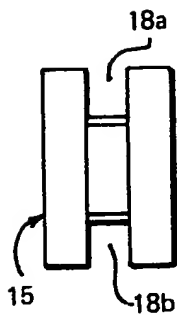


Fig. 4e.

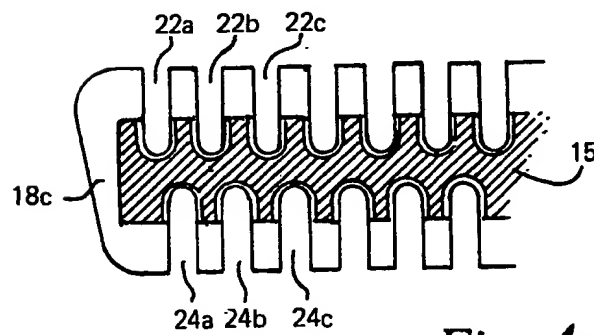


Fig. 4d.

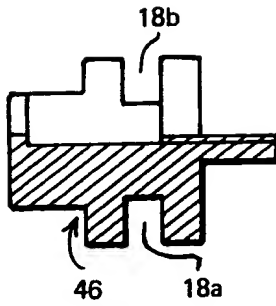


Fig. 5b.

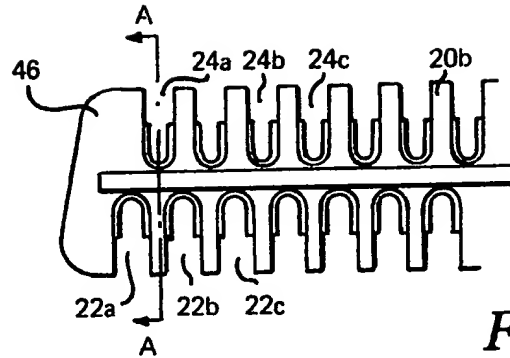


Fig. 5a.

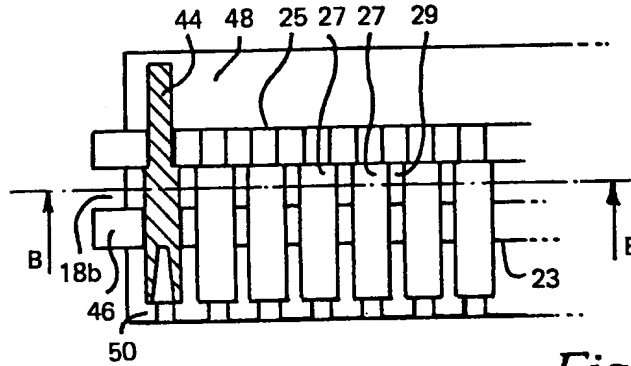


Fig. 5c.

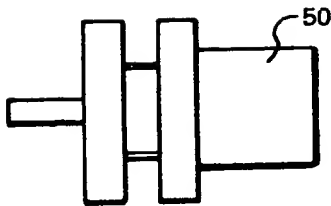


Fig. 5f.

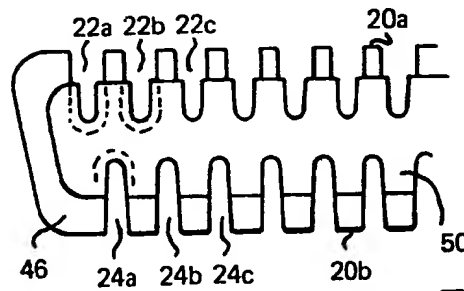


Fig. 5e.

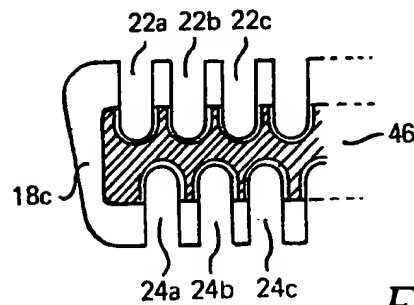


Fig. 5d.

DESCRIPTION

ELECTRICAL MULTIPLE CONTACT CONNECTOR

The present invention relates to electrical multiple contact connectors of the plug and/or socket type which act as a coupling device to provide a junction between two electrical cables, or between an electrical cable and a chassis.

In conventional multiple contact connectors, such as data transmission cable 'D' type connectors, a plug connector (as illustrated in Fig.1) is used to terminate the cable 2 forming the data transmission line. This plug connector has a plurality of male contacts 3a, 3b, 3c ... 3a', 3b', 3c' ... in the form of pins spaced apart in two mutually parallel rows and supported in a moulded, generally bar-shaped housing unit 4 such that opposite ends of each pin protrude from opposite parallel surfaces of the moulding. The moulded housing unit 4 can be secured by means of a shroud 5 and screws 6 in a two-part plug casing 7a, 7b such that protruding ends of the pins 3 on one side of the moulded unit 4 project outwardly of the plug casing 7a, 7b and the shroud 5. The shroud 5 further defines an outer shield surrounding the pins 3 and acts to guard the pins against damage and as a guide during mating of the plug connector 1 with a socket connector (not shown). Protruding ends of the pins 3,

on the other side of the moulded housing unit 4, project into the plug casing 7a, 7b and each can be connected through soldering or crimping to individual wires 2a, 2b, 2c ... of the cable 2. The plug casing 7, normally comprises two dissimilar half shell mouldings 7a, 7b, one half shell moulding 7b forming the housing into which the moulded housing unit 4 is secured by means of the shroud 5 and screws 6 and into which cable 2 is secured by securing means 10 through opening 11 in half shell moulding 7b of plug casing 7, whilst the other half shell moulding 7a forms a lid. The lid can be screwed into a tight fitting relationship with half shell moulding 7b by screw 8 and screw socket 9, in order to form a closed unit plug casing 7 with the pins 3, surrounded by a shield section of the shroud 5, protruding from one end through opening 12 and with the cable 2 protruding from an opposite end, through an opening 11.

The problem with existing D-type connectors of this construction is that, since the sequence of connected pins or sockets required can vary unpredictably from one application to another, considerable time can be wasted during installation or initial assembly, in achieving the correct cable connections.

In the soldering method of fixing the individual wires 2a, 2b, ... of the cable to the pins 3a, 3b ... the pins 3a, 3b ... are generally permanently fixed in the moulded housing unit 4 and the individual wires 2a, 2b, ... of the cable 2 are soldered thereon. This is often an intricate and time consuming process due to the narrow separation of the pins and has the disadvantage of possibly producing a faulty solder joint (dry joint), which is difficult to identify and if a false connection is made and is consequently changed, or a different combination of wire/pin connections are required at a later date thereby necessitating the rewiring of the plug, has the further disadvantage of increasing the possibility of a faulty solder joint.

In the crimping method of fixing the individual wires 2a, 2b, ... to the cable pins 3a, 3b, ... the pins are often demountable from the moulded housing unit 4. This is because it is very difficult to crimp individual pins "in-situ". The pins are therefore connected to the wire before the pins are inserted in the moulded housing unit 4. The insertion of the pins in conventional connectors involves use of an insertion tool. The pin being pre-connected to its wire, is pushed into the required hole in the rear of the moulded housing unit 4 until it "snaps" past a

constriction. The insertion tool is required chiefly to guide the nose of the pin through the various inner diameters of the hole and also to exert pressure to overcome the resistance caused by a built-in constriction. If a pin is inserted into the wrong hole or the sequence of pins is to be altered at a later date for a different application, an extraction tool is needed to remove the pin from the moulded housing unit. The extraction tool, being of a slightly larger diameter, forces open the constriction of the housing unit, allowing the pin or socket to be pushed out. This operation has the following disadvantages.

Firstly, it is not possible to extract the pins without exerting pressure on the "sharp" end of the pin whilst simultaneously holding both the extractor tool and the moulded housing unit, making it a cumbersome operation. There is also a risk of damaging the pin or pulling the wire away from the pin due to the pressure exerted during extraction, therefore necessitating the need for re-crimping the wire to the pin. For a private individual, who wishes to alter the wiring of the plug for a particular application, or who wishes to fix the plug to a cable, this involves the purchase of not only an insertion and extraction tool, but also the purchase of a

relatively expensive crimping tool, if the cable is not to become obsolete if a pin is accidentally pulled away from the wire. The process is also relatively time consuming, especially during the initial manufacturing stage, adding greatly to the production time and cost.

Additionally, the conventional design of the connector casing has the disadvantage that, due to the cable entry point, two dissimilar half shell mouldings for the casing are required, necessitating two separate moulding units for its production.

It is an object of the present invention to provide an electrical multiple contact connector in which a sequential arrangement of each electrical contact member can be changed repeatedly without the use of special tools.

It is a further object of the present invention to provide an electrical multiple contact connector in which the number of mouldings for its production is greatly reduced whilst utilizing existing pins and sockets, thereby enabling connections with existing connector plugs or sockets.

It is a further object of the present invention to provide an electrical multiple contact connector which can utilize either crimped or soldered contacts.

In accordance with a first aspect of the present invention a multiple contact plug connector is provided which has a pin holder member into which a multiplicity of pins can be transversely inserted or "snapped" and then locked in place by a slidable fastening means.

Preferably, the pin holder member is formed with a plurality of open slots into which the individual pins can be inserted, by displacement of each pin in a direction generally transverse to its longitudinal axis.

Preferably, the pin holder member is formed as a one piece moulded member.

Preferably, the slidable fastening means comprises two slidable fastening members which are adapted to enable one or more pins to be unlocked to allow their removal from the pin holder, whilst retaining the remaining pins locked.

In accordance with a second aspect of the present invention a multiple contact socket connector is provided which has a one-piece moulded socket holder into which a multiplicity of sockets can be transversely inserted or "snapped" and then locked in place by a slidable fastening means.

Preferably, the socket holder is formed as a one piece moulded member.

The slidable fastening means preferably comprises two slidable fastening members which are adapted to enable the removal of one or more sockets from the socket holder, whilst retaining the remaining sockets locked.

The invention is described further hereinafter, by way of example only, with reference to the accompanying drawings, in which:-

Fig.1a is an exploded perspective view of a known 'D' type pin connector;

Fig.1b is a diagrammatic front view of the connector of Fig.1a, showing the pin layout;

Fig.1c is a diagrammatic plan view showing the pins extending from a pin holder member;

Fig.2 is an exploded view of one embodiment of a multiple pin connector in accordance with the present invention;

Fig.3a is a schematic front view of a locking piece forming part of the embodiment of Fig.2;

Fig.3b is a section along the line A-A of Fig.3a;

Fig.3c is a schematic rear view of the locking piece of Fig.3a;

Fig.3d is a section taken along the line B-B of Fig.3c;

Fig.4a is a schematic front view of one embodiment of a pin holder member in accordance with the present

invention (inverted with respect to Fig.2);

Fig.4b is a section along the line A-A of Fig.4a;

Fig.4c is a schematic plan view of the pin holder member of Fig.4a, with one pin inserted therein;

Fig.4d is a section along the line B-B of Fig.4c;

Fig.4e is a schematic view of the pin holder of Fig.4a turned through 180°;

Fig.4f is an end view of the pin holder of Fig.4e;

Fig.5a is a schematic front view of one embodiment of a socket holder in accordance with the present invention (inverted with respect to the plug of Fig.2);

Fig.5b is a section along the line A-A of Fig.5a;

Fig.5c is a schematic plan view of the socket holder of Fig.5a, with one socket element inserted therein;

Fig.5d is a section along the line B-B of Fig.5c;

Fig.5e is a schematic front view of the socket holder of Fig.5a, inverted through 180°;

Fig.5f is an end view of the socket holder of Fig.5e;

Fig.6 is a schematic view of a pin for use in the connector of Fig.2; and

Fig.7 is a schematic view of a socket.

A multiple pin connector in accordance with the present invention can be in the form of either a plug or a socket. The description which follows is

concerned principally with a plug-type connector, by way of a preferred example. The plug-type connector, shown in a partially assembled condition in Fig.2, comprises a plurality of special pins 3 which are releasably mounted in a pin holder 14 by means of a pair of identical slidable locking pieces 16', 16'', as described hereinafter.

Each pin 3 as represented in Figs. 2 and 6 generally comprises first and second shank portions 3', 3''' interconnected by an intermediate waist portion 3'' of greater diameter than both portions 3', 3'''. The first portion 3' is of smaller diameter than the second portion 3''' and has a rounded or pointed free end. The shank portion 3''' has facilities thereon for allowing the connection of a lead, for example by crimping or soldering. The pin 3 can be formed, for example, by stamping a suitable shape from sheet metal and folding the shape to form the pin 3.

Each of the two identical slidable locking pieces 16' 16'' as illustrated in Figs. 3a to 3d is formed in one piece from an electrically insulating material, such as a suitable plastics material. Each locking piece 16 is substantially U-shaped, having two parallel arms 16a, 16b interconnected by a base 16c. As shown in Fig.3b, the arms 16a, 16b are of L-shaped

cross-section, and are of approximately half the thickness of the base portion 16c, as viewed in Fig.3d. The base portion 16c contains a slot 16j whose inner end is rounded. The undersides of the free ends of the arms 16a, 16b, as viewed in Fig.3d, are chamfered obliquely at 16e. The undersides of the inner ends of the arms 16a, 16b are connected to a shoulder 16g on the base portion 16c by way of a further oblique portion 16f, as shown in Figs. 3c and 3d.

The pin holder 14, as illustrated in Figs. 2 and 4a to 4f, comprises a generally rectangular block 15 of an electrically insulating material, having a respective central longitudinal channel 18a,18b in each of its upper and lower side surfaces 20a,20b, as viewed in Figs.2, Figs 4e and 4d, the channels 18a,18b being continued around the left and right-hand end surfaces of the block as viewed in the latter figures and as indicated at 18c in Fig.4d. The block 15 also contains a first plurality of equally spaced slots 22a,22b ... in its upper side surface 20a extending perpendicularly to, and intersecting, the channel 18a. The block 15 further contains a second plurality of equally spaced slots 24a, 24b ... in its lower side surface 20b extending perpendicularly to, and intersecting, the channel 18b. The spacing of the

slots 24 is the same as that of the slots 22. However, as shown in Figs. 4e and 4d, the slots 22a, 22b .. are offset laterally in relation to the slots 24a, 24b .. by half the pitch spacing between adjacent slots.

As shown in Fig.4c, each slot 22 or 24 is adapted to receive a respective pin 3 of the type shown in Fig.6 in a manner such that the pins project uniformly from, and perpendicularly to, front and rear faces 23,25 of the pin holder block, as shown in the left-hand slot 24a of Fig.4c. In order to accomplish this, the width of the channels 18a, 18b is arranged to be slightly greater than the axial length of the intermediate thickened waist portions 3'' of the pins 3 so that the latter portions 3'' are received snugly between the opposed walls of these channels to ensure positive axial location of the pins relative to the pin holder 14. The base of each channel 18a,18b is provided with a plurality of recesses 27 for receiving the thickened waist portions 3'' of the pins. These recesses have a depth corresponding to the diameter of the intermediate thickened waist portions 3'' of the pins 3, the remaining portions of the bases of the channels 18a,18b forming a plurality of lands 29 disposed between the recesses 27 and which therefore serve to separate adjacent pins in the transverse

direction. Since the leading end of the pins (shank portion 3') is of smaller diameter than the rear end (shank portion 3'''), the widths of the slots 22,24 on one side of the block 15 (lower side as viewed in Fig.4c) must be slightly less, and the depths slightly more, than on the other side (upper side as viewed in Fig.4c) in order to ensure that the pins project perpendicularly from the front face 23 of the block 15.

Thus, the pin holder block 15 is formed so that it can receive in its two sets of slots 22,24 a plurality of the pins 3, with the leading ends of these pins projecting uniformly from the front surface 23 of the block and the rear ends, connected to respective leads 31, projecting from the rear surface. It will be appreciated that because the thickened waist portions of the pins lie in the recesses 27, the pins lie wholly below the level of the base of the longitudinal channels 18a,18b in each case. Thus, even with all pins inserted, the two channels 18a,18b remain clear.

It will also be appreciated that the pins can be inserted into the slots 22,24 after they have been coupled to the leads 31. Furthermore, they can easily be removed and inserted into other slots 22,24 for the purpose of rearranging the connections.

The pins 3 are retained in their selected slots 22,24 by means of the pair of locking pieces 16',16''

which slide along the channels 18a,18b, as shown in Fig.2. As shown in the latter figure, during assembly, one of the locking pieces 16' is displaced to the left, with the opposed leg portions 32a,32b of its L-shaped arms 16a,16b sliding along the upper and lower channels 18a,18b respectively of the pin holder block. The other locking piece 16'' is inverted in relation to the locking piece 16' and is displaced to the right, with the opposed legs 32a,32b of its L-shaped arms 16a,16b also sliding along the upper and lower channels 18a,18b of the pin holder block so as to overlap the arms 16a,16b of the locking piece 16'. It will be appreciated that, in order to accommodate this arrangement, the transverse width of the channels 18a,18b must be slightly greater than twice the thickness "t" of the leg portions 32b. With both locking pieces displaced fully over the pin holder, their base portions 16c engage respectively against the opposite longitudinal ends of the pin holder block so that the pin holder is fully surrounded by the locking pieces around the whole of its lateral periphery. In this condition the oblique portions 16e of each locking piece abut against the oblique portion 16f of the other locking piece.

By selectively withdrawing the two locking pieces 16 along the channels 18a,18b any particular slot

22,24 can be exposed between the opposed ends of the arms 16a,16b and its associated pin removed whilst all other slots 22,24 remain closed by the arms 16a,16b.

The locking pieces in their fully inserted positions, as well as holding the pins 3 in place, also provide a means for mounting the pin holder block in position within a metal shroud 32 (Fig.2) having a conventional shield/guide section 32c and two rivetted-on metal bushes 32a,32b. The bushes 32a, 32b are dimensioned and positioned to extend through the recesses 16j of the locking pieces.

The assembly comprising the pin holder block 15, the two locking pieces 16 and the metal shroud 32 is mounted to a two-part casing 34 formed from two identical half-shells 34a,34b, incorporating sockets 36 through which a fastening means, e.g. bolts, can secure together the two half shells.

A cable clamp 38 is incorporated as a separate acetyl moulding, within the casing 34 (see Fig.2). The clamp 38 is formed in the shape of a V, but with one arm of the V shorter than the other and the apex of the V having protruding shaft portions 38a, 38b which are matable with recesses 40 formed in each of the half shell moulding 34a,34b. The cable clamp has the dual purpose of acting as a closure for one of two alternative cable entry points 42 to the casing 34,

with the longer arm of the V acting as the closure member.

In practice, the pin holder block 15 is preferably formed as a one-piece moulding. In order to be able to form the various recesses and channels therein, the moulding tool for forming same parts at 90° to the notional axes of the pins rather than parallel to them, as in the formation of conventional connectors of this general type.

As an additional feature, the outer faces of the casing 34 can incorporate a diagram of the correct flex trimming lengths. Also, a recess can be included in the outer face to allow for the inclusion of a label identifying the purpose of the plug.

In the event that the connector is to be a socket as opposed to a plug, instead of the pins 3 a plurality of socket elements 44 are used. Referring to Fig.7, the socket elements have a front bifurcated portion 44' connected to a rear shank portion 44'' by a thickened intermediate waist portion 44'''.

Figs.5a to 5f show a socket holder 46 for receiving the socket elements 44. The socket holder 44 is basically the same as the pin holder 15 of Figs. 4a to 4f and only the differences will therefore be described. Identical or equivalent parts in the two embodiments are given the same reference numbers. As

will be evident from a comparison of Figs. 4a to 4f and Figs. 5a to 5f, in order to provide secure support for the socket members 44, the basic pin holder block is modified by the addition of: (a) a rearwardly extending baffle plate 48 which serves to separate the rearwardly projecting ends of the portions 13''' of the socket members which are connected to the respective cable leads 31, e.g. by soldering or crimping; (b) a forwardly extending support portion 50 which continues the slots 22,24 forwardly of the housing block in order to provide a seat for the bifurcated portions 44' of the socket elements over their whole length (see Fig.5c). A further difference is that the ends of the slots 22,24 on the forward sides of the channels 18a,18b are widened to accommodate the greater diameter of the socket elements (see again Fig.5c).

The socket elements are held in place in exactly the same manner using a pair of the locking pieces 16 which slide from opposite directions along the channels 18a,18b so that individual socket elements 44 can be removed or inserted whilst all others are retained in their slots 22,24 by the locking pieces.

Although reference has been made throughout the description to a 'D' type connector, where a pin or socket holder is basically box shaped, the invention

could also apply to other forms of connectors, where the basic form of the pin or socket holder is not necessarily box shaped. For example, 'DIN' style audio connectors which consist of round-bodied plugs containing between three and eight pin/socket lines, or the SCART system connections used in TV/video applications.

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CLAIMS

1. A multiple contact plug connector which has a pin holder member into which a multiplicity of pins can be transversely inserted or "snapped" and then locked in place by a slidable fastening means.

2. A multiple contact plug connector as claimed in claim 1, in which the pin holder member is formed with a plurality of open slots into which the individual pins can be inserted, by displacement of each pin in a direction generally transverse to its longitudinal axis.

3. A multiple contact plug connector as claimed in claim 1 or 2, in which the pin holder member is formed as a one-piece moulded member.

4. A multiple contact plug connector as claimed in claim 1, 2 or 3, in which the slidable fastening means comprises two slidable fastening members which are adapted to enable one or more pins to be unlocked to allow their removal from the pin holder, whilst retaining the remaining pins locked.

5. A multiple contact plug connector as claimed in claim 4, in which the pin holder comprises generally a block of an electrically insulating material, having a respective central longitudinal channel in each of a pair of opposite side surfaces.

6. A multiple contact plug connector as claimed in claim 5, in which the pin holder block contains a first plurality of equally spaced slots in its one said side surface, extending perpendicularly to, and intersecting, the channel associated with that side surface; and a second plurality of equally spaced slots in the other of said side surfaces, extending perpendicularly to, and intersecting, the channel associated with the latter side surface.

7. A multiple contact plug connector as claimed in claim 6, wherein the spacing of the individual slots in each of said two pluralities of slots is the same, but the slots in one of said two pluralities of slots are offset laterally in relation to the other slots by half the pitch spacing between adjacent slots.

8. A multiple contact plug connector as claimed in claim 5, 6 or 7, wherein each pin comprises first and second shank portions separated by an intermediate waist portion of greater diameter than both shank portions.

9. A multiple contact plug connector as claimed in claim 8, wherein the width of said channels is arranged to be slightly greater than the axial length of the intermediate thickened waist portions of the pins so that the latter portions are received snugly between the opposed walls of the channels to ensure

positive axial location of the pins relative to the pin holder.

10. A multiple contact pin connector as claimed in claim 9, wherein the base of each channel is provided with a plurality of recesses for receiving the thickened waist portions of the pins, the recesses having a depth corresponding to the diameter of the intermediate thickened waist portions of the pins, and the remaining portions of the bases of the channels forming a plurality of lands disposed between the recesses and which serve to separate adjacent pins in the transverse direction, the pins being retained in their slots by means of the pair of slidable fastening members which are adapted to slide along the channels from opposite directions.

11. A multiple contact socket connector which has a one-piece moulded socket holder into which a multiplicity of sockets can be transversely inserted or "snapped" and then locked in place by a slidable fastening means.

12. A multiple contact socket connector as claimed in claim 11, in which the socket holder is formed as a one piece moulded member.

13. A multiple contact socket connector as claimed in claim 6, in which the slidable fastening means preferably comprises two slidable fastening

members which are adapted to enable the removal of one or more sockets from the socket holder, whilst retaining the remaining sockets locked.

14. A multiple contact plug or socket connector substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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Amendments to the claims
have been filed as follows

1. A multiple contact plug connector which has a pin holder member formed with a plurality of open slots into which pins can be individually inserted or "snapped", by displacement of each pin in a direction generally transverse to its longitudinal axis, and then locked in place by a slidable fastening means, the slidable fastening means comprising two slidable fastening members which are adapted to enable one or more of the pins to be unlocked to allow their removal from the pin holder, whilst retaining the remaining pins locked.

2. A multiple contact plug connector as claimed in claim 1, in which the pin holder member is formed as a one-piece moulded member.

3. A multiple contact plug connector as claimed in claim 1 or 2, in which the pin holder comprises generally a block of an electrically insulating material, having a respective central longitudinal channel in each of a pair of opposite side surfaces.

4. A multiple contact plug connector as claimed in claim 3, in which the pin holder block contains a first plurality of equally spaced slots in its one said side surface, extending perpendicularly to, and intersecting, the channel associated with that side surface; and a second plurality of equally spaced

slots in the other of said side surfaces, extending perpendicularly to, and intersecting, the channel associated with the latter side surface.

5. A multiple contact plug connector as claimed in claim 4, wherein the spacing of the individual slots in each of said two pluralities of slots is the same, but the slots in one of said two pluralities of slots are offset laterally in relation to the other slots by half the pitch spacing between adjacent slots.

6. A multiple contact plug connector as claimed in claim 3, 4 or 5, wherein each pin comprises first and second shank portions separated by an intermediate waist portion of greater diameter than both shank portions.

7. A multiple contact plug connector as claimed in claim 6, wherein the width of said channels is arranged to be slightly greater than the axial length of the intermediate thickened waist portions of the pins so that the latter portions are received snugly between the opposed walls of the channels to ensure positive axial location of the pins relative to the pin holder.

8. A multiple contact pin connector as claimed in claim 7, wherein the base of each channel is provided with a plurality of recesses for receiving the thickened waist portions of the pins, the recesses

having a depth corresponding to the diameter of the intermediate thickened waist portions of the pins, and the remaining portions of the bases of the channels forming a plurality of lands disposed between the recesses and which serve to separate adjacent pins in the transverse direction, the pins being retained in their slots by means of the pair of slidable fastening members which are adapted to slide along the channels from opposite directions.

9. A multiple contact socket connector which has a one-piece moulded socket holder into which a multiplicity of sockets can be transversely inserted or "snapped" and then locked in place by a slidable fastening means comprising two slidable fastening members which are adapted to enable the removal of one or more sockets from the socket holder, whilst retaining the remaining sockets locked.

10. A multiple contact socket connector as claimed in claim 9, in which the socket holder is formed as a one piece moulded member.

11. A multiple contact plug or socket connector substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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